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(71)(72) Applicant and Inventor: JELLESEN, Poul [NO/NO]; Torget 5, N–3210 Sandefjord (NO).

(74) Agent: HELGERUD, Jan, E.; Bryns Patentkontor A/S, P.O. Box 765, Sentrum, N–0106 Oslo (NO).

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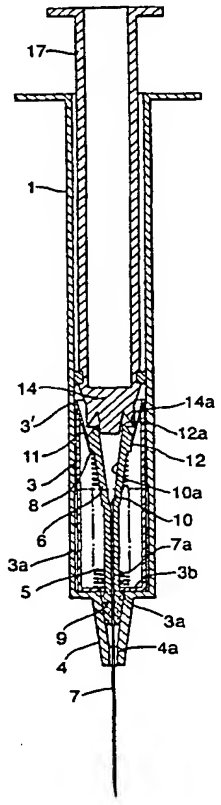
(54) Title: DISPOSABLE HYPODERMIC SYRINGE WITH AUTOMATICALLY RETRACTABLE NEEDLE

(57) Abstract

A disposable hypodermic syringe having an automatically retractable needle (7) wherein the needle holder (6) and needle (7) by means of a pre–set compression spring (5) arranged between an annular collar (2) on the needle holder (6) and the syringe housing (1) base where syringe nozzle (4) is located, is pushed inside the syringe housing (1) in that a locking member (11) in the syringe housing (1) is disengaged from a supporting face (12) on the needle holder (6) by means of the syringe plunger head (14) upon completion of injection, the plunger head (14) being pressed against the locking member (11) for said disengagement. The locking member (11) is constituted by a funnel–shaped, conical, deformable/elastic annular element (11), whose one, upper end portion (11b) having the largest diameter rests sealingly against and is fixed in relation to the inside wall of the syringe housing (1), and whose other, lower end portion (11a) having the smallest diameter rests sealingly against the collar (12) which is an annular collar and is arranged at the upper portion of the needle holder (6), whereby the compression spring (5) is maintained in a pre–set state. The circular end portion of the plunger head (14) has a diameter that is slightly larger than the lower end portion (11a) of the funnel–shaped, conical annular element (11), in order, on depression of the plunger head (14) towards the needle holder (6), to deform/expand the lower end portion (11a) of the funnel–shaped, conical annular element (11), thus disengaging it from the annular collar (12) in order to release the compression spring (5) so as to obtain said retraction of the needle holder (6) with the needle (7).



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DISPOSABLE HYPODERMIC SYRINGE WITH AUTOMATICALLY RETRACTABLE NEEDLE

The present invention relates to a disposable hypodermic syringe of the type disclosed in the preamble of independent claim 1 below, and where the syringe is rendered non-functional and prevents reuse and also prevents the hypodermic needle from harming others after use.

A number of different types of syringes are known and have previously been used where the hypodermic needle is removable and can be replaced with a new one once the syringe is empty. Syringes of these types can be used several times both for repeated injections administered with the same needle to the same person and to administer injections to different people once the needle has been changed. Problems arise when such syringes are distributed to drug addicts who administer injections to themselves anywhere and where the same syringe may be used by several persons, resulting in the danger of the transmission of infectious agents. The same danger occurs when such syringes are thrown away with the needle still fitted or perhaps removed but thrown away together with the actual syringe in outdoor areas. Those who may easily be harmed by these syringes are primarily children who find syringes and needles in outdoor areas, but they may also harm other people who pick them up when clearing such an area.

Various attempts have been made to solve the above-mentioned problems, such as the solution taught in US 5,211,629. This document describes a disposable hypodermic syringe with a retractable needle where the needle and needle holder are retracted into the syringe housing after the completion of an injection with the aid of a compressed spring arranged around the needle and in compressed contact between a collar on the needle holder and the base of the syringe housing.

The needle holder is secured in the syringe housing by means of a locking member of deformable material releasably secured to the inside of the syringe housing. This locking member has a central passageway in which an annular flange on the needle holder is releasably secured. By consciously applying further pressure to the syringe plunger after completing the injection of all or a part of the injection fluid, the end portion of the plunger will press on and displace the locking member downwards, thereby releasing the annular flange on the needle holder whereby the compression

spring will push/press the needle inside the hollow plunger rod of the syringe after penetrating a membrane on the head end of the plunger.

One drawback of this solution is that the plunger rod must consciously be pressed further in after the injection has been completed in order to release the retracting mechanism.

If the disposable syringe is used carelessly, it could still be a danger to the surroundings, i.e., both in organised conditions such as in hospitals, doctors' surgeries etc. and in non-organised conditions as described above.
The aforementioned drawbacks are obviated by means of the disposable hypodermic syringe mentioned in the introduction which is characterised by the features disclosed in the characterising clause of independent claim 1 below and in the subsequent dependent claims.

Accordingly, the disposable hypodermic syringe comprises a locking member constituted by a funnel-shaped, conical/deformable, elastic annular element, whose one, upper end portion having the greatest diameter rests sealingly against and is fixed relative to the inner wall of the syringe housing, and whose other, lower end portion having the smallest diameter rests sealingly against a collar which is annular and is arranged at the upper portion of the needle holder whereby the compression spring is maintained in a pre-set state. The circular end portion of the plunger head has a diameter that is somewhat larger than the lower end portion of the funnel-shaped, conical annular element, in order, on depression of the plunger head towards the needle holder, to expand/deform the lower end portion of the funnel-shaped, conical annular element, thereby disengaging it from locking engagement with the annular collar at the upper portion of the needle holder. In this way, the compression spring is released so as to obtain said retraction of the needle holder and needle into the syringe housing.

To simplify production of the aforementioned disposable syringe, the needle holder with needle and locking member and pre-set compression spring may be made as one unit which is then placed in the syringe housing, as disclosed in the characterising clause in claim 2 below.

Thus, one of the embodiments comprises a tubular circular unit mounted inside the syringe housing and the end of which facing the plunger head is open and surrounded by a thin-walled circular sleeve having a funnel-shaped, conical deformable annular

element which extends into the sleeve and allows radial expansion, and whose end portion having the smallest diameter faces the syringe nozzle to form a sealing, releasable abutment against a rigid circular projection at the inner end of the needle holder. The outer sides of the needle holder are parallel with and offset in relation to the outer sides of the funnel-shaped, conical annular element and are made having an annular collar for holding the needle holder against the end of the funnel-shaped, conical thin-walled annular element which is made of a deformable and possibly slightly elastic material which permits a radial expansion/deformation and sealing abutment. This sealing abutment is provided via a steel compression spring having a diameter smaller than the internal diameter of the collar, and which with one end thereof presses against a second circular collar in a lower position on the needle holder and with the other end thereof presses against the end wall of the sleeve facing the syringe nozzle.

The end of the needle holder where the inlet aperture of the needle is located has a internal conical shape which ends in a circular sharp-edged termination the diameter of which is smaller than the annular collar for the locking member, and from where a conical face extends down to said collar.

The free end of the plunger head has a circular, rigid projection having a diameter greater than the smallest diameter of the conical annular element of the locking member at the annular collar on the needle holder, whereby the plunger head with said circular projection will, upon depression of the plunger head when giving an injection, be pressed against the deformable/elastic, funnel-shaped, conical annular element of the locking member and thus deform or expand this so that it releases the needle holder, whereupon the pre-set compression spring will press the needle inside the tubular sleeve of the syringe housing during the simultaneous retraction of the needle holder, the plunger head and the plunger rod into the syringe housing. The needle is preferably put under sideways tension by spring action whilst, during the assembly, a plug is pressed into the interior central conical passage of the syringe nozzle, thereby preventing any advance of the needle out through the central passage of the syringe nozzle in the end portion of the syringe housing once it has been retracted

One embodiment of the disposable hypodermic syringe according to the invention will be described below with reference to the appended drawings, wherein:

Figure 1 shows a longitudinal section through a unit comprising a sleeve with a locking member, needle holder with needle and a pre-set compression spring arranged in the sleeve, which components together constitute a unit for placement in the lower part of a syringe housing in abutment against the base of the syringe housing where the syringe nozzle is located, and at the upper end of the unit there is shown a syringe plunger head in position for the aspiration of fluid into a disposable syringe having said unit mounted as shown in Figures 4 and 7 below;

Figure 2 shows a longitudinal section in the form of an exploded view, through the locking member, the needle holder with needle and syringe head;

Figure 3 shows a longitudinal section like that in Figure 1 where the needle holder with needle is shown with a pre-set steel compression spring during insertion into the sleeve with the locking member into a locked position, as shown in Figure 7 below;

Figure 4 shows a longitudinal section through a complete disposable syringe including the aforementioned unit having therein a pre-set and locked steel compression spring and where the syringe plunger rod with plunger head is shown in a position ready for the aspiration of fluid;

Figure 5 shows the same as Figure 4, but where the plunger head has been pressed in against the conical annular element of the locking member, expanding/deforming it so that it has become disengaged from the needle holder, thereby preparing the needle holder with needle for retraction into the syringe housing with the aid of the pre-set steel compression spring;

Figure 6 shows the same as Figure 5, but having a retracted needle holder with needle and the released, slackened steel compression spring;

Figure 7 shows on a larger scale a longitudinal section through a part of the syringe housing with syringe nozzle of a disposable syringe where the steel compression spring has been compressed outside the needle holder inside the sleeve with the locking member and locked by said member, and with the plunger head almost fully depressed against the locking member; and

Figure 8 shows the same as Figure 7, but with the plunger head pressed fully in towards the needle holder and in against the deformable/elastic, funnel-shaped, conical annular

element of the locking member in the sleeve, whereby this has been expanded/deformed and disengaged from its locking position against a collar on the needle holder, thereby enabling the compressed steel compression spring to press the needle holder and plunger back inside the syringe housing.

The embodiment of a disposable syringe illustrated in the drawing comprises, as shown in Figs. 4-8, a syringe housing 1 with syringe nozzle 4 and plunger rod 17 with plunger head 14. A unit comprising a thin-walled sleeve 3a which has a base 3b with a central opening 3c has been inserted into the syringe housing 1. The sleeve 3a surrounds a needle holder 6 with needle 7 which projects out through said central opening 3c. Said base 3b constitutes a supporting face for a pre-set compression spring 5 which with its upper end rests against an annular collar 8 on the needle holder 6. The needle holder has an upward facing annular collar 12 for interaction with a locking member 11 which is constituted by a funnel-shaped, conical, deformable/elastic annular element, whose one, upper end portion 11b having the greatest diameter rests sealingly against and is fixed relative to the syringe housing 1. This fixing and sealing is achieved in the illustrated embodiment in that a thin-walled sleeve 3 is connected to said upper end 11b of the funnel-shaped, conical annular element 11 where there may also be provided a thickening 3' for forming a seal and fixation against the syringe housing wall.

The lower end portion 11a of the funnel-shaped, conical, elastic annular element rests sealingly and releasably against said annular collar 12 on the needle holder 6 with the aid of the compression spring 5 which has a diameter smaller than the internal diameter of the collar 12.

The end of the needle holder 6 where the inlet opening 10 of the needle 7 is located has an internal conical shape with interior walls 10a which end in a circular, sharp-edged termination 12a whose diameter is smaller than that of the annular collar 12. Thus an external conical wall connection 12b is formed which extends down towards the annular collar 12.

The circular end portion of the plunger head 14 comprises an axial annular projection 14a having an outside diameter equal to or greater than the outside diameter of the annular collar 12. Said annular projection 14a consists of a cylindrical portion which becomes a conical diverging portion 14' of the plunger head 14. The taper of the conical diverging portion 14' is almost equal to the taper of the deformable/elastic funnel-shaped annular element 11 in order to allow maximum depression of the plunger

head 14, thereby reducing the residual volume of injection fluid prior to the release of the locking member 11.

The illustrated embodiment of the plunger head 14, shown most clearly in Figure 1, comprises a central, conical downward converging projection 14b surrounded by the annular projection 14a, the interior wall surface of which forms a conical upward converging space, which together with the projection 14b is designed to interact with a correspondingly shaped end portion of the needle holder 6 in order to reduce the residual volume of injection fluid prior to the release of the locking member 11.

By depressing the plunger head 14 with the aid of the plunger rod 17 upon administering an injection, the plunger head 14 will be pressed to rest against the deformable/elastic, funnel-shaped, conical annular element 11, thereby expanding/deforming this and disengaging its lower end portion 11a from the annular collar 12 on the end portion of the needle holder 6, thus enabling the pre-set steel compression spring 5 to press the needle holder 6 with needle 7 inside the syringe housing whilst simultaneously retracting the plunger head 14 and plunger rod 17.

On the needle 7 there is mounted a loose plug 9 which during the assembly of the prefabricated unit comprising the locking member 11, the sleeve 3a, the needle holder 6 with needle 7 and the pre-set compression spring 5 in the syringe housing 1, will be pressed into the central passage 4a of the syringe nozzle 4. Said plug 9 will serve as a lateral support for the needle 7.

Upon completed injection and retraction of the needle holder 6 with needle 7 into the syringe housing 1, the said plug will prevent the needle 6 from moving forward again, as the needle is under slight sideways tension and will not be able to meet the central passage in the plug 9, and thus the needle will also be prevented from moving forward again through the central passage 4a in the syringe nozzle 4 in the end portion of the syringe housing 1.

In a second - non-illustrated - embodiment of the locking member 11 which consists of the said conical deformable and/or elastic annular element 11, the funnel-shaped, conical annular element 11 has one or more rupture lines, for example, running from the lower end portion 11a towards the upper end portion 11b. This enables an expansion in the form of a breaking up of the lower portion 11a of the funnel-shaped, conical annular element 11 on depression of the plunger head 14, and which thus presses the resultant

flaps or tongues out of locking engagement with the annular collar 12 on the needle holder 6.

In this embodiment, the funnel-shaped, conical annular element 11 may consist of a non-elastic or brittle material. The annular element 11 will then be broken into pieces by the plunger head 14 upon completion of the injection for the release the needle holder 6 and the retraction thereof with the needle 7 into the syringe housing 1.

Patent claims

1.

A disposable hypodermic syringe having an automatically retractable needle (7) wherein the needle holder (6) and needle (7) by means of a pre-set compression spring (5) arranged between an annular collar (8) on the needle holder (6) and the syringe housing (1) base where syringe nozzle (4) is located, is pushed inside the syringe housing (1) in that a locking member (11) in the syringe housing (1) is disengaged from a supporting face (12) on the needle holder (6) by means of the syringe plunger head (14) upon completion of injection, the plunger head (14) being pressed against the locking member (11) for said release, characterised in that the locking member (11) is constituted by a funnel-shaped, conical, deformable/elastic annular element (11), whose one, upper end portion (11b) having the largest diameter rests sealingly against and is fixed in relation to the inside wall of the syringe housing (1), and whose other, lower end portion (11a) having the smallest diameter rests sealingly against the collar (12) which is annular and is arranged at the upper portion of the needle holder (6), whereby the compression spring (5) is maintained in a pre-set state, and that the circular end portion (14a) of the plunger head (14) has a diameter that is slightly larger than the lower end portion (11a) of the funnel-shaped, conical annular element (11), in order, on depression of the plunger head (14) towards the needle holder (6), to deform/expand the lower end portion (11a) of the funnel-shaped, conical annular element (11), thereby disengaging it from locking engagement with the annular collar (12) at the upper portion of the needle holder (6) in order to release the compression spring (5) so as to obtain said retraction of the needle holder (6) with the needle (7) inside the syringe housing (1).

2.

A disposable hypodermic syringe according to claim 1, characterised in that the locking member (11) is connected by its upper end portion (11b) to one end of a thin-walled sleeve (3a) which has a base (3b) having a central opening (3c), which sleeve (3a) surrounds the needle holder (6) with needle (7) which projects out through said central opening (3c), and that said base (3b) forms a supporting face for the pre-set compression spring (5), whereby the locking member (11), the sleeve (3a), the needle holder (6) with needle (7) and the pre-set compression spring (5) constitute one unit arranged in the lower part of the syringe housing (1) and lying against the syringe housing (1) base (1a) where syringe nozzle (4) is located.

3.
A disposable hypodermic syringe according to claim 2, characterised in that the upper end portion (11b) of the locking member (11) comprises an elastic thin-walled sleeve (3) which projects down on the outside of and in contact with the sleeve (3a).

4.
A disposable hypodermic syringe according to claim 3, characterised in that the upper portion (3') of the sleeve (3) has a thickening for the formation of a seal against the inside wall of the syringe housing (1).

5.
A disposable hypodermic syringe according to claim 3, characterised in that the upper portion of the sleeve (3) is made in the form of a sealing lip dimensioned for press fit against the inside wall of the syringe housing (1).

6.
A disposable hypodermic syringe according to claim 1, characterised in that the circular end portion of the plunger head (14) comprises an axial annular projection (14a) having an outer diameter equal to or slightly greater than the outer diameter of the annular collar (12).

7.
A disposable hypodermic syringe according to claim 6, characterised in that said annular projection (14a) is composed of a cylindrical portion which becomes a conical diverging portion (14') of the plunger head (14).

8.
A disposable hypodermic syringe according to claim 7, characterised in that the taper of the conical diverging portion (14') is almost identical to the taper of the funnel-shaped deformable/elastic annular element (11) so as to allow maximum depression of the plunger head (14), thereby reducing the residual volume of the injection fluid prior to the release of the locking member (11).

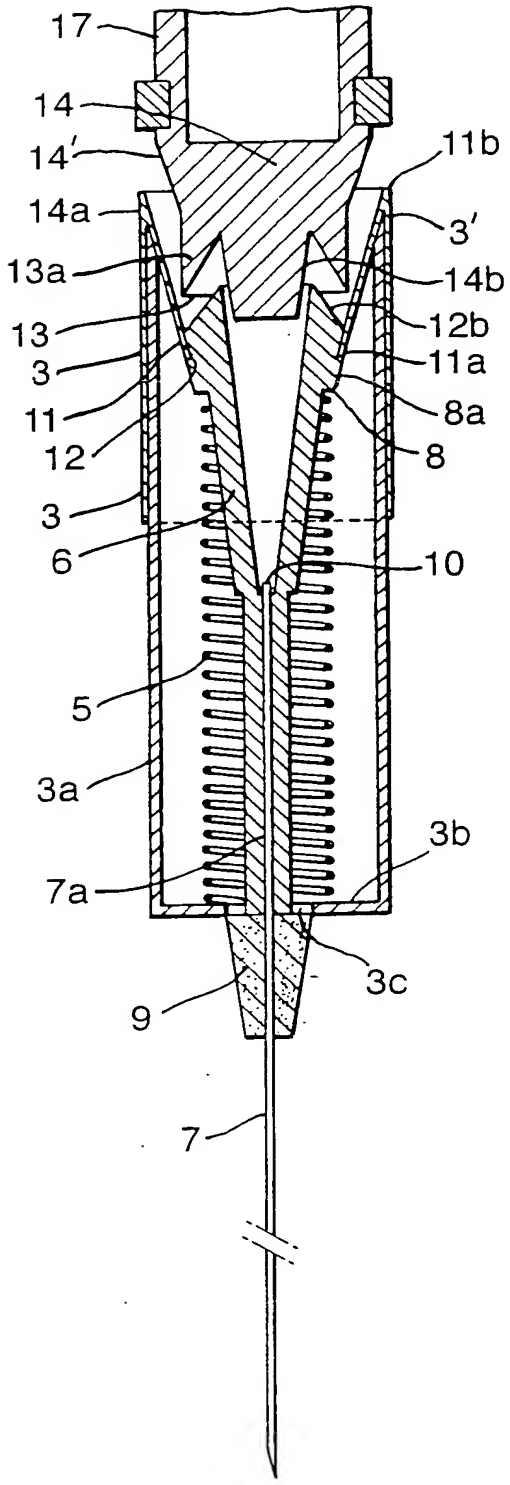
9.
A disposable hypodermic syringe according to any one of claims 6-8, characterised in that the plunger head (14) comprises a central conical downward converging projection

(14b) surrounded by the annular projection (14a) whose inside wall surface forms a conical upward converging space, which together with the projection (14b) is intended to interact with a correspondingly designed end portion of the needle holder (6) in order to reduce the residual volume of injection fluid prior to the release of the locking member (11).

10.

A disposable hypodermic syringe according to claim 1, characterised in that the funnel-shaped, conical annular element (11) has at least one rupture line running from the lower end portion (11a) towards the upper end portion (11b) to facilitate the expansion or rupturing of the end portion (11a) of the funnel-shaped, conical annular element (11), and thus the release of the needle holder (6) for the retraction thereof and the needle (7).

Fig.1.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3c

Fig.2.

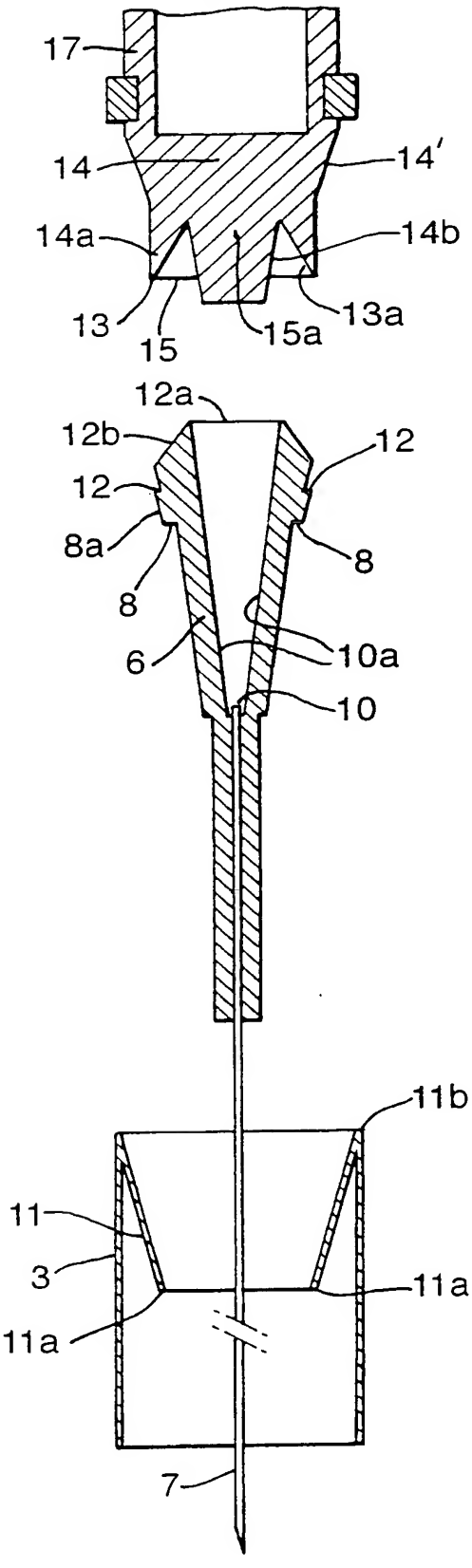
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Fig.3.

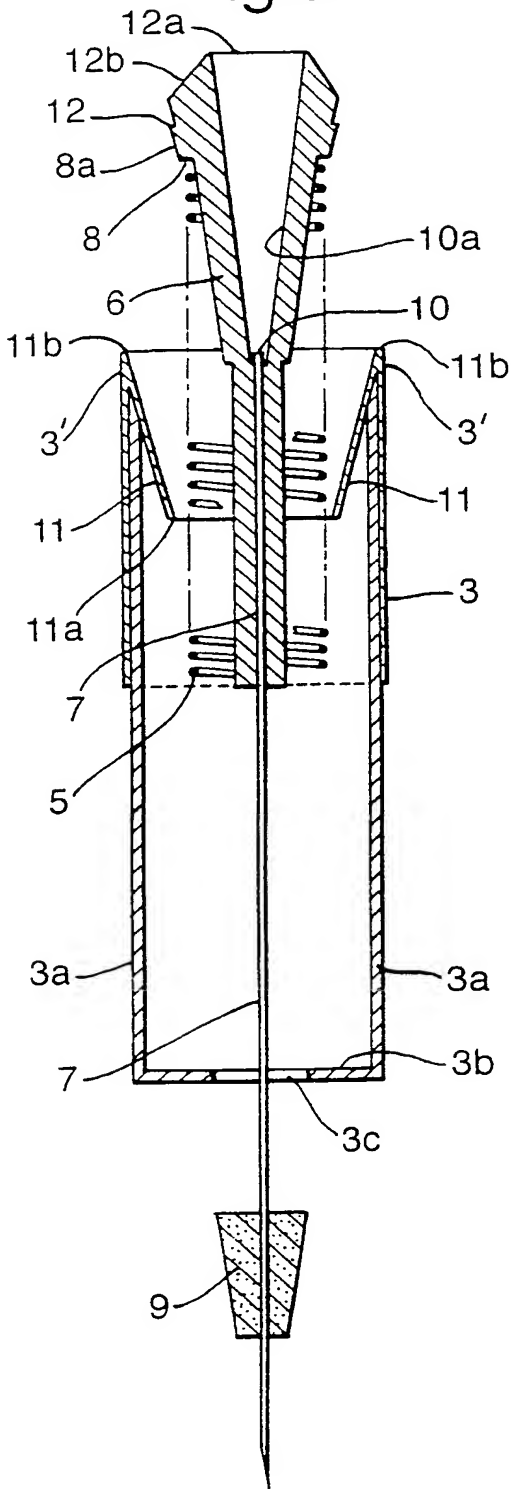
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Fig.4.

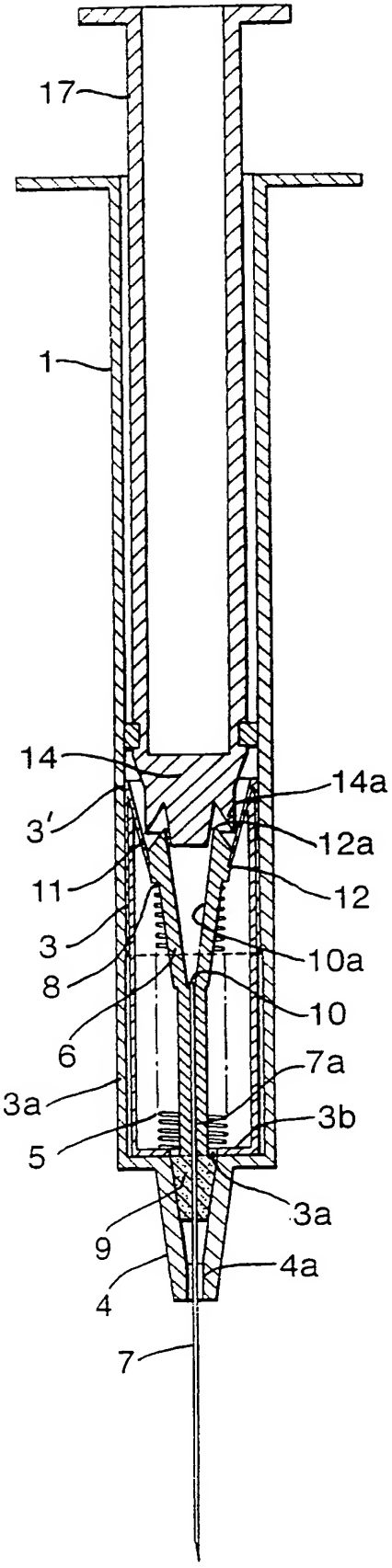
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Fig.5.

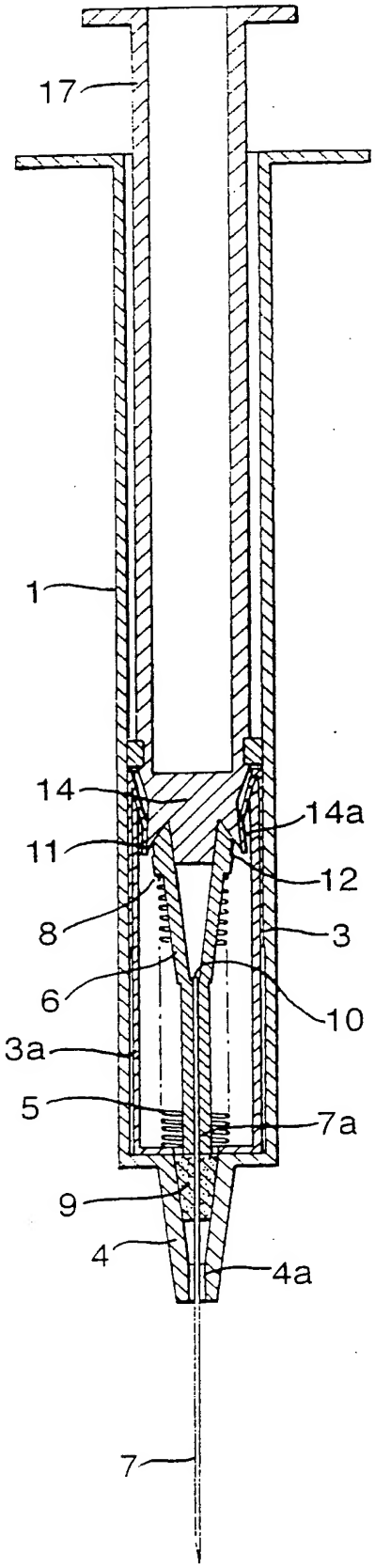
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Fig.6.

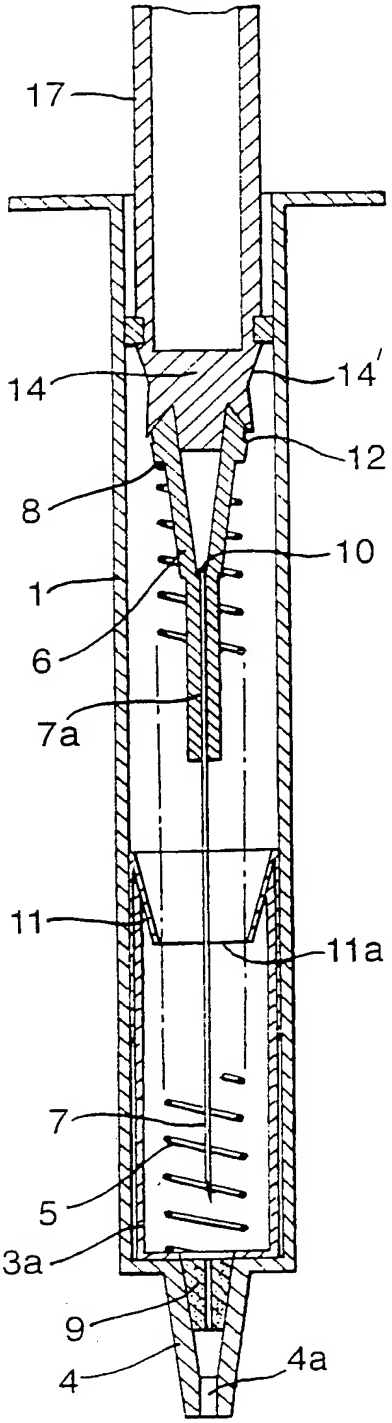
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Fig.7.

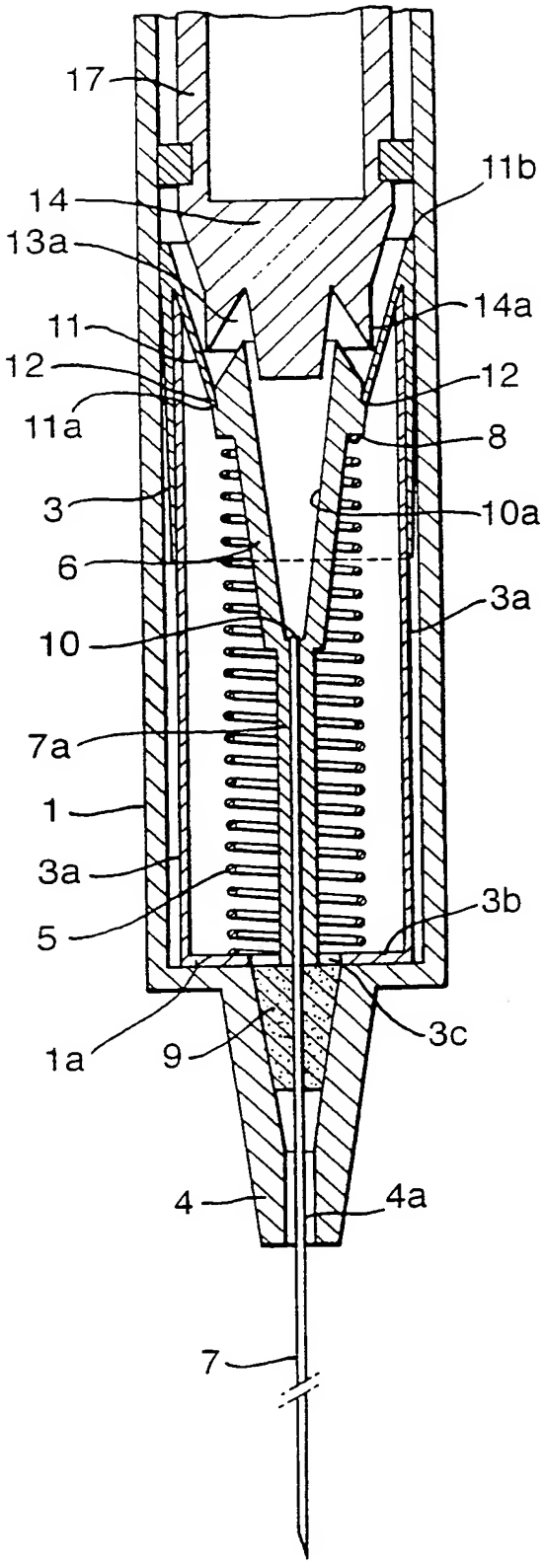
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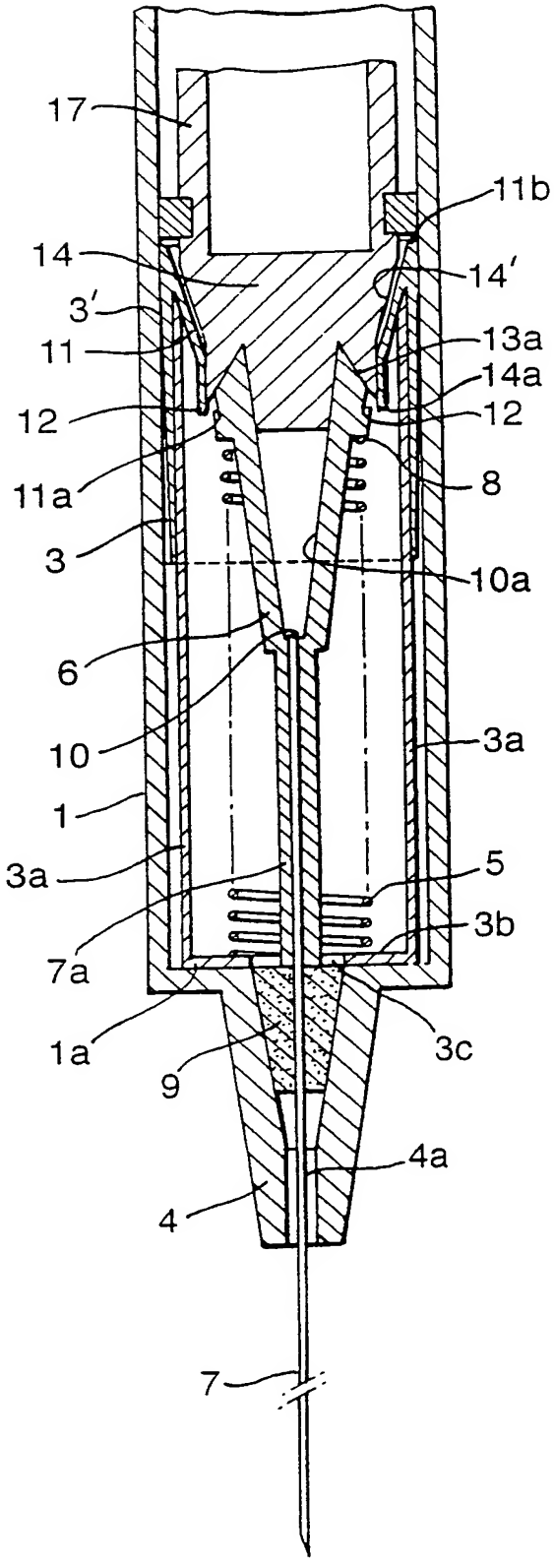
Fig.8.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INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 00/00132

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61M 5/32
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5211629 A (WILLIAM B. S. PRESSLY ET AL), 18 May 1993 (18.05.93) --	1-10
A	US 5407436 A (JOHN F. TOFT ET AL), 18 April 1995 (18.04.95) --	1-10

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Information on patent family members

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